Converting Computer Power Supplies

— an easy way

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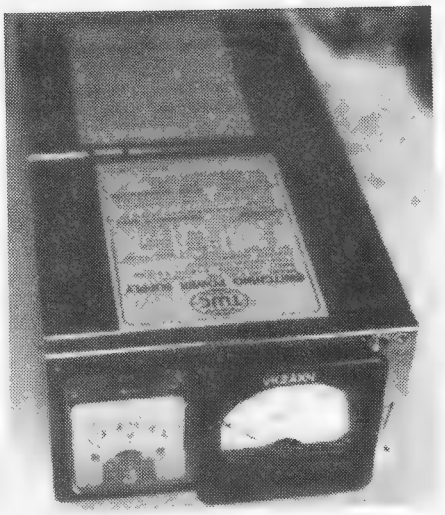


THERE HAVE BEEN ARTICLES in several journals recently (1,2) describing how to convert computer switch-mode power supplies to provide 13.8 volt at up to 20 amp to power amateur equipment.

After several unsuccessful attempts to reproduce their results, including a couple of spectacular electronic disasters, I concluded that most of my problems were caused by pushing the units beyond their capacity.

Most of the readily available (and cheap) ex-computer supplies, from the 286 -386 types of computer, are rated at up to 200 watt — not a starter for the desired output. But even a 240 watt unit expired when converted to 13.8 volt and operated at 15 amp.

The conversion wasn't an easy job, requiring tracing of the control circuit and modification of the printed circuit board and the high frequency transformer. I found this difficult because none of the supplies I acquired conformed to the circuits published in the literature, particularly in the control and overload sections.

It occurred to me that a better method would be to use two power supplies suitably coupled together to provide the required output. Power handling capacity should be adequate and conversion much simpler.

So I obtained two identical 200 watt units and modified as follows:

The waveform generator in these supplies is usually a 16-pin chip, TL494 or equivalent, which produces the 30kHz (approx.) square wave drive for the chopper transistors. Pin 1 controls the waveform for regulation of the output voltage. My modification is simply to disconnect the resistor connecting pin 1 to the 5 volt output, at the 5 volt end, and connect in series a 10k trimpot. Adjustment of this enables the output voltage to be increased (in my supplies) to 7.1 volt before the supply trips.

By adjusting two such supplies each to 6.9 volt and connecting them in series it is possible to obtain 13.8 volts at (nominally!) 20 amp.

Connecting two in series requires that one supply has its earth-to-case connection disconnected. This is simple — just cut the PCB track at the one corner where it earths the supply via one of the mounting screws.

Then the two can be bolted together and connected in series. I left one cooling fan in place but reversed it to blow rather than suck; also I added an ammeter and a voltmeter at the end vacated by the second fan.

Regulation can be improved by drawing a standing current (in my case, 2 amp) through a heavy 3 ohm resistor added to each PCB but this does reduce slightly the maximum current for external load. However please note that despite the nameplate rating of the +5 volt output at 20 amp on these supplies, I do not believe they are designed for this continuously and I do not recommend trying it!

However my supply happily endures peak loads of up to 17 amps for SSB use with my TS 430S without a flicker of voltage variation, and can provide 15 amp continuously without distress.

Four further points are important: -

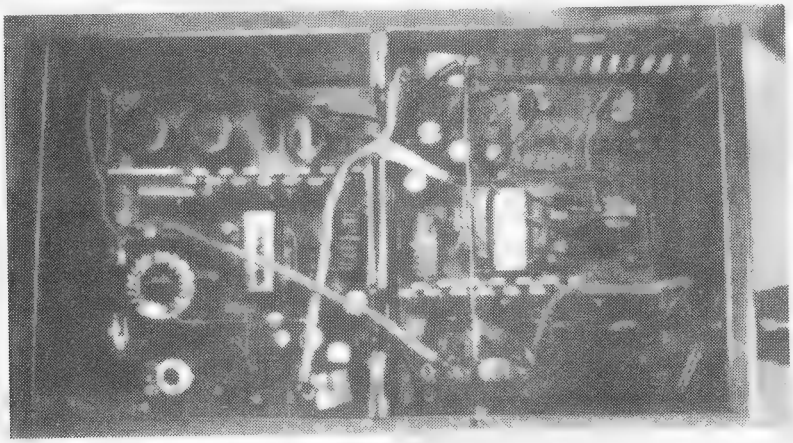
1) Pushing up the output from 5 to 6.9 volt causes the nominal +12 volt output to rise also, to about 16.5 volt. I have not bothered to change anything related to this, although it may be getting close to the limit for the 12 volt circuit filter capacitors. Nothing has gone wrong after a couple of months of daily use.

   I did not remove any components at all from the +12V, -12V, or -5V circuits because in previous tries at conversion of single units I found that some of these components were relevant to the control and overload systems and I failed miserably to trace the circuitry!

2) The increase in the +12 volt line means that the fan will run faster and be noisier. In my case I put a 25 ohm resistor in series with the fan.

3) There was some harmonic interference from the approx. 30 kHz chopper audible on 40 metres but not on higher frequency bands — I cured this by extra filtering of the output using two extra toroids (from previously destroyed units!) in series, with 0.01microfarad capacitors each side to earth.

4) MOST IMPORTANT! These supplies are probably the most lethal bit of equipment any amateur is likely to handle. Take care! Some of the PCB circuitry is at 340 volt DC with hefty capacity behind it, and is also connected directly to the mains. This applies to all of it up to and including the HF transformer. The DC output is fully isolated and quite safe. But handling the boards out on the bench is hazardous — best to make the simple modifications, re-install in the cases, and adjust with a long insulated tool.



References: -

1) Phil Harman, Radio and Communications, November & December 1998.

2) Leo Simpson, Silicon Chip, December 1998.

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